Math 1148: Midterm Exam 3

Instructions:

- Show ALL work to receive full credit. Answers with insufficient supporting work will receive little or no credit.

- Please CIRCLE your answers

- If you find the solution to a problem using a graph from your calculator (where allowed), you need to sketch that graph and label all relevant information.

Some Formulas that may be Useful:

\[
A = P \left(1 + \frac{r}{n}\right)^n \quad A = Pe^{rt} \quad A = Pa^t \quad A = P(1+r)
\]

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1. a. Express \( D^x = 8x \) in logarithmic form. (5 points)

b. Express \( \log_m 16 = 5k \) in exponential form. (5 points)

c. State the domain of the function \( f(x) = 4 \log_{11} (23 - x) \). Give your answer in interval notation. (5 points)

d. Find the decimal approximation of \( \log_2 \pi + \log_2 9 \) correct to five decimal places. (5 points)

*Be sure to show all of your work.*
2. Algebraically solve the equation: \[ 13^{x-6} = 11^{5x+8} \] (10 points)

*Give the exact answer only. Calculator answers will receive no credit.*
3. Algebraically solve for $x$. (10 points)

$\log_2 (3 - x) + \log_2 (1 - x) = 3$

*Give the exact answer only. Calculator answers will receive no credit.*
4. a. Tim invests $1800 into an account that pays 8% interest compounded monthly. How long will it take for his $1800 investment to grow to $6500? Round your answer to the nearest hundredth of a year. (10 points)

b. The 1906 earthquake in San Francisco had a magnitude of 7.8 on the Richter scale. During the same year there was an earthquake with a magnitude of 4.6 on the Richter scale in Japan. How many times more intense was the San Francisco earthquake than the earthquake in Japan? The Richter scale is $M = \log \frac{I}{S}$ where $M$ is the magnitude of the earthquake, $I$ is the intensity of the earthquake at the epicenter, and $S$ is the intensity of the “standard” earthquake. Round your answer to one decimal place. (10 points)
5. a. Assuming $w > 3$, expand the expression $\log \left( \frac{\sqrt[8]{w^7}}{\sqrt[8]{8(w-12)^5}} \right)$ as much as possible. (6 points)

b. Express as a single logarithm: $9 \ln (1 - 5b) - \frac{1}{4} \ln b + \ln \left( b^2 + 16 \right)$ (6 points)
6. A 120 gram sample of cesium-137 will decay to 80 grams in 12 years.

a. Find an equation that will model how much of our sample $C$ will remain after $t$ years. (9 points)

b. Use your answer from part a) to determine how long it will take until 30% of the sample remains. Round your answer to the nearest tenth of a year. (8 points)
7. Algebraically solve for $x$. \hspace{1cm} (11 points)

*Give the exact answer only. Calculator answers will receive no credit*

$$xe^{2x} + 13xe^x = 30x$$